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(54) Steering column mounting assemblies

(57) A mounting assembly 10 for adjustably supporting a tubular jacket 12 of a vehicle steering column comprises a support bracket 14 with slotted depending side members 16 and 18, a split bush 22 around the jacket, a yoke-like U-section sheet metal clamp 28 located between the bush and the side members *inter alia* by a key member 72, and a selectively operable actuator 54.

In a locking condition, the actuator (shown as a quick-release cam arrangement) provides for clamping of the jacket; in a release condition of the actuator, spring-back of the sheet metal clamp, due to the inherent spring characteristics of the metal primarily in the region of a bridge portion 48 of the clamp, releases the jacket for adjustment of the longitudinal position and the rake of the column.

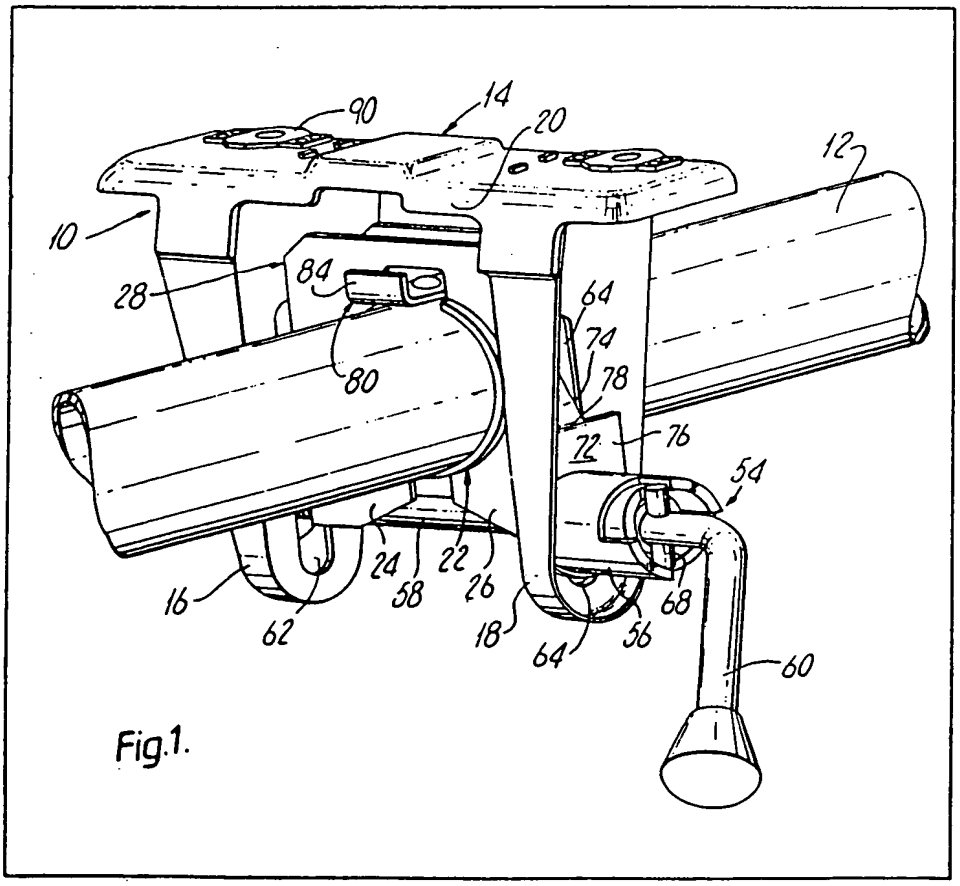

Fig.1.

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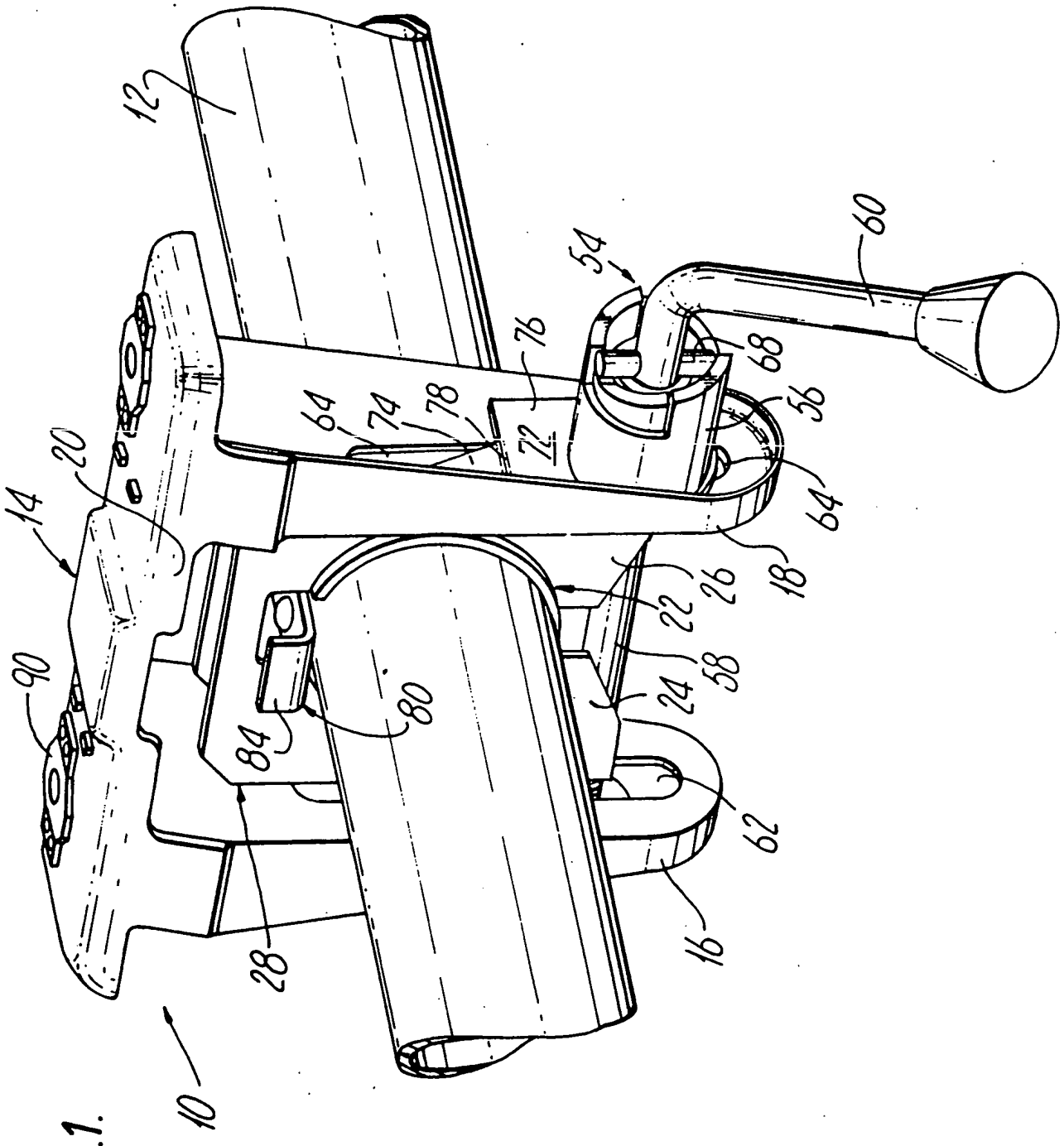
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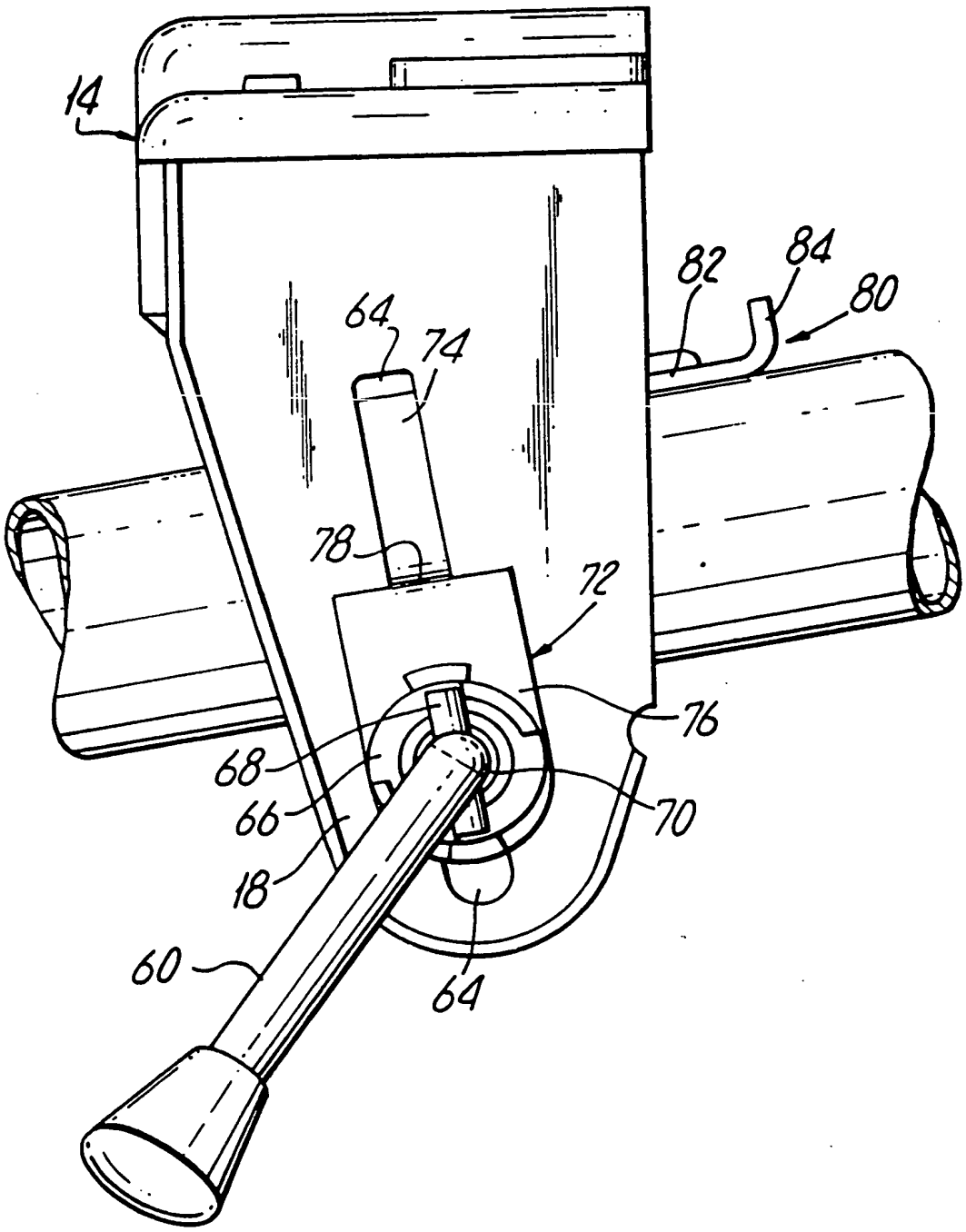
Fig.1.

Fig.2.



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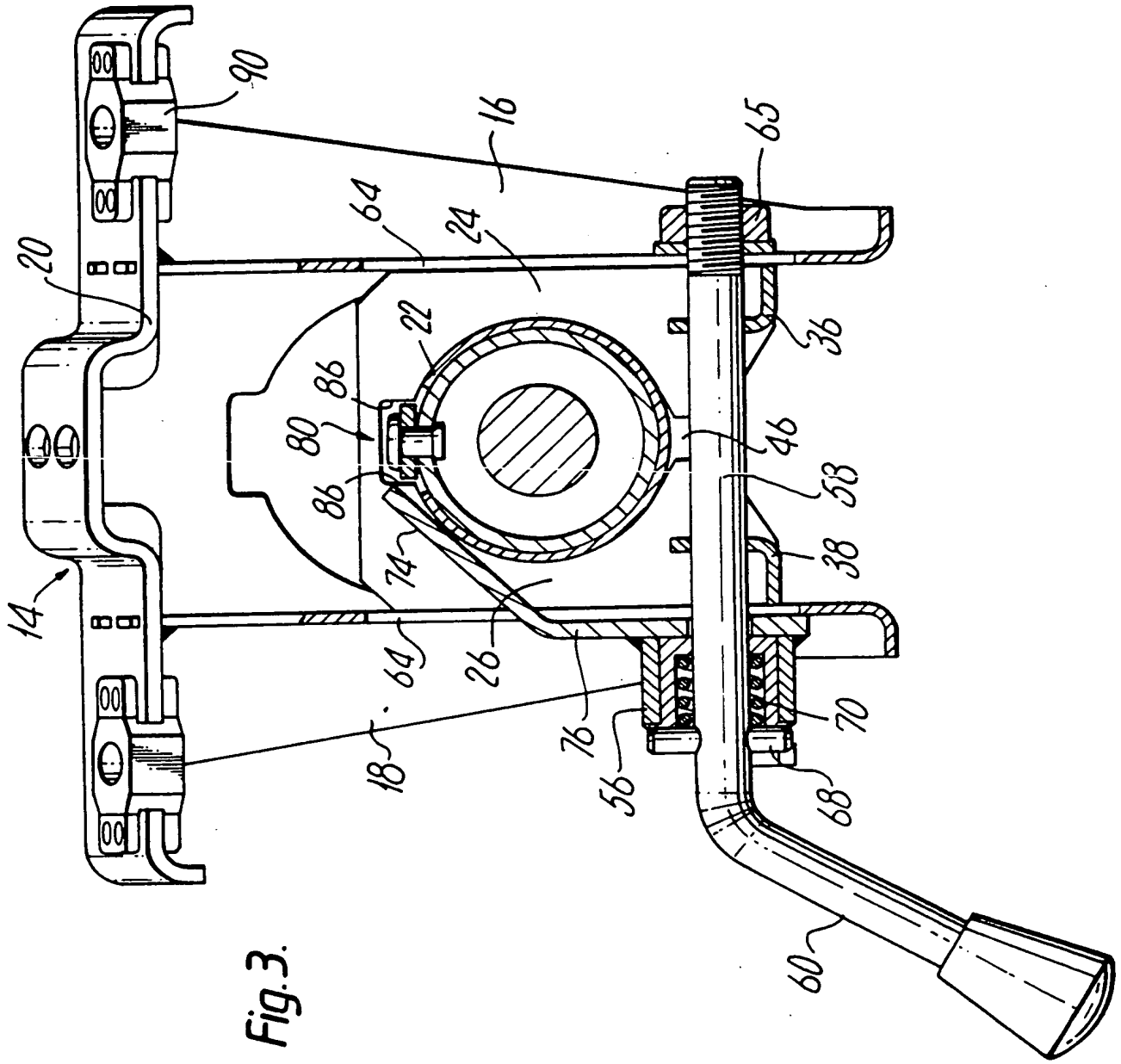

Fig.3.

Fig.4.

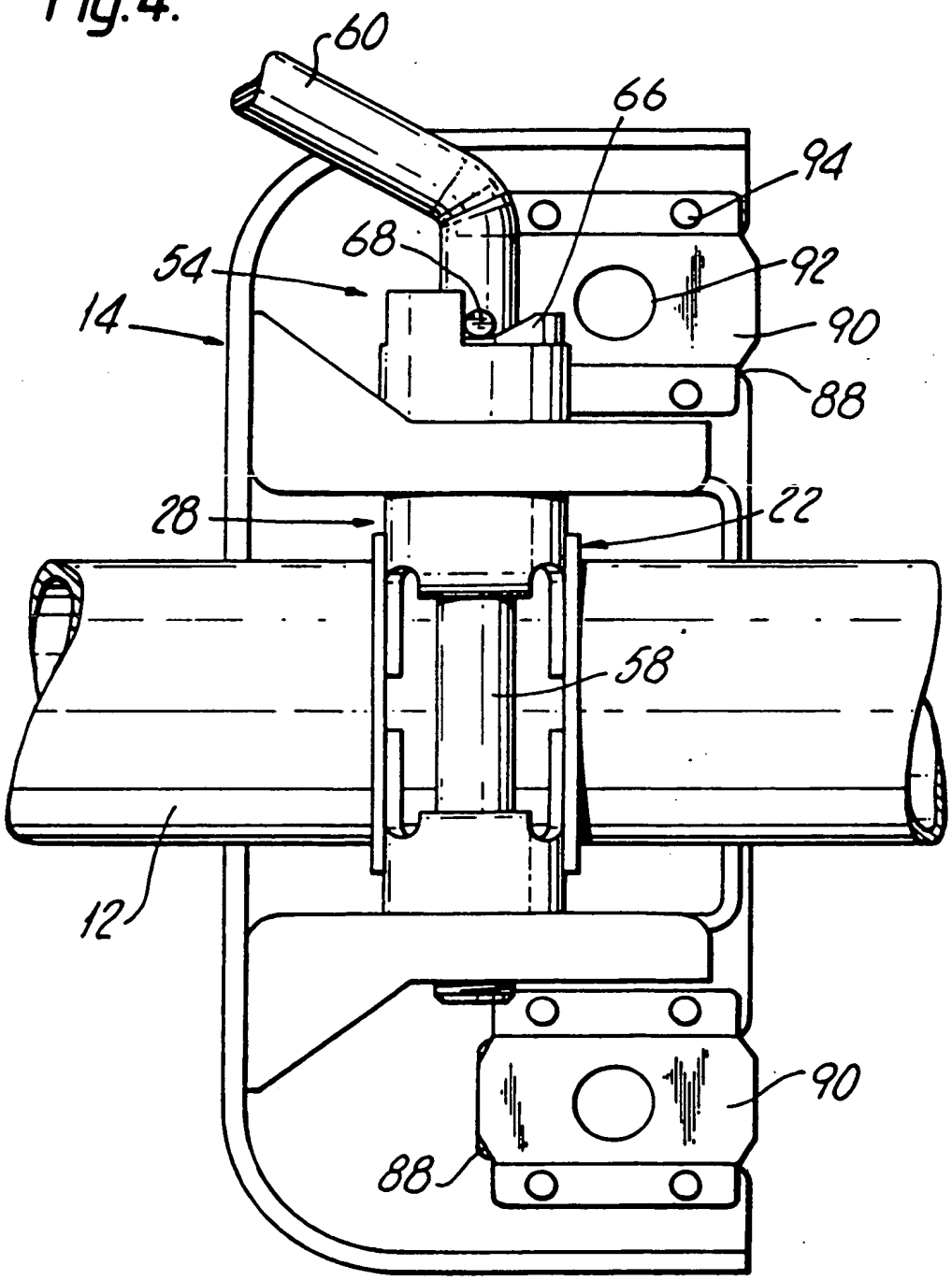

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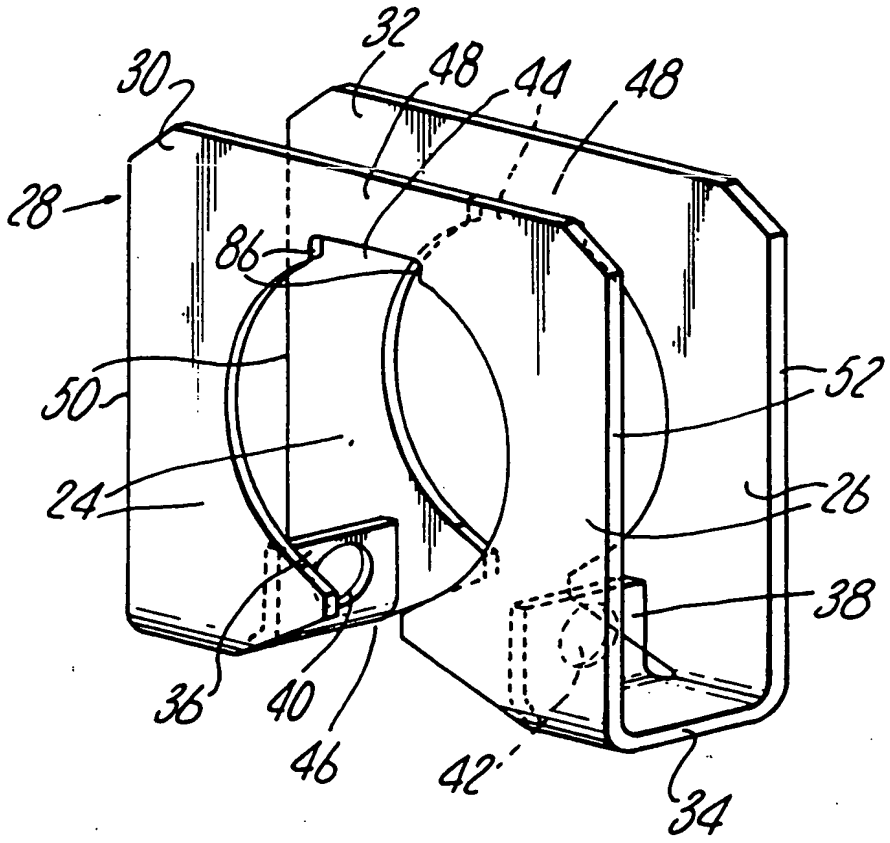
Fig. 5.



SPECIFICATION

Steering column mounting assemblies

This invention relates to mounting assemblies for adjustably supporting a tubular jacket of a steering column relative to a body portion of a vehicle.

In a conventional form of a vehicular steering column, a steering shaft for transmitting steering effort from the vehicle's steering wheel to a steering gear is surrounded by a tubular jacket. The steering gear, which generally incorporates a universal coupling (Cardan joint), in effect forms a pivotal mounting for the lowermost end of the column, and an upper mounting assembly is required to co-operate with the tubular jack to provide support at the upper part of the column. In practice, the mounting assembly at the upper part of the column can provide a useful anti-rotation and anti-penetration characteristic for the column jacket; additionally, the mounting assembly may be required to permit adjustment of the position of the column jacket.

By the present invention there is provided a mounting assembly for adjustably supporting a tubular jacket of a steering column relative to a body portion of a vehicle, comprising a U-shaped bracket adapted to be secured to the vehicle body portion and including a pair of spaced side members interconnected by a connecting portion, a resilient bush adapted to engage around a portion of the tubular jacket, a U-section sheet metal clamp received between the side members of the bracket and comprising opposed jaw portions which accommodate the bush and are interconnected by a resilient bridge portion, locating means effective to maintain the position of the sheet metal clamp relative to the bracket, and selectively operable actuator means having a release condition for permitting adjustment of the position of the tubular jacket and a locking condition in which the spaced side members of the bracket, and thereby the opposed jaw portions of the sheet metal clamp, are moved towards one another for locking the tubular jacket in its adjusted position.

A mounting assembly in accordance with the invention includes parts which have the potential to be made relatively light in weight and to be relatively inexpensive to manufacture. Such a mounting assembly also provides at least a basis for meeting the other requirements mentioned above.

In a preferred form of the mounting assembly, the side members of the U-shaped bracket are formed with respective slots, which may be of shallow arcuate form, such that in the release condition of the actuator means, adjustment movement of the tubular jacket can take place in a vertical plane, for altering the rake of the column to meet driver requirements.

The U-section sheet metal clamp is conveniently pressed or stamped from a one-piece blank, and preferably includes a pair of spaced bent-up lugs that are apertured to accommodate a rod which extends through the two slots in the bracket side members and forms part of the actuator means. The sheet metal clamp forms what may be termed a "metallurgical hinge", utilising the inherent spring characteristics of steel (which is the preferred material for the clamp), primarily in the region of the bridge portion of the clamp, to provide what is effectively a springy yoke giving a very adequate clamping action from a part which is relatively light in weight and inexpensive to manufacture.

In the accompanying drawings:

Figure 1 is a perspective view of one embodiment of a mounting assembly in accordance with the present invention adjustably supporting a tubular jacket of a steering column;

Figure 2 is a fragmentary elevation of the mounting assembly shown in Figure 1;

Figure 3 is a cross-section, with parts in elevation, of the mounting assembly shown in Figure 1;

Figure 4 is a fragmentary under plan view of the mounting assembly shown in Figure 1; and

Figure 5 is a perspective view of a U-section sheet metal clamp forming a "metallurgical hinge" in the mounting assembly shown in Figures 1 to 4.

As is shown in the drawings, a mounting assembly 10 for adjustably supporting a tubular jacket 12 of a steering colum relative to a body portion of a vehicle includes a U-shaped bracket 14 adapted to be secured to the vehicle body portion (not shown). The U-shaped bracket 14 includes a pair of depending arms forming spaced side members 16 and 18, interconnected by a transversely extending connecting portion 20 of the bracket.

A channel-section axially split bush 22 of low-friction plastics material (acetal resin in this embodiment) is engaged around a portion of the tubular jacket 12, and is itself accommodated within opposed jaw portions 24 and 26 of a U-section sheet metal clamp 28 that is received between the side members 16 and 18 of the U-shaped bracket 14. The bush 22 could alternatively be made of nylon (polyamide resin), or for some applications could be replaced by a split bush of steel or other metal. The natural resilience of the split bush 22 retains the bush in position against correspondingly curved facing surfaces of the jaw portions 24 and 26, with the side portions of the channel-shaped cross-section of the bush forming retainer flanges preventing relative movement of the bush 22 and clamp 28 in the longitudinal direction of the column jacket 12.

The U-section sheet metal clamp 28 is shown in more detail in Figure 5. The clamp 28 in this embodiment is pressed from a one-piece steel blank about 2 mm in thickness, to form first and second planar portions 30 and 32 which extend parallel to each other and are interconnected by a bend portion 34. A pair of spaced lugs 36 and 38 are bent up from facing end regions of the bend portion 34, and are provided with aligned apertures 40 and 42 respectively. The curved facing surfaces of the opposed jaw portions 24

and 26 of the U-section sheet metal clamp 28 provide part-circular seats for the channel section split bush 22, the pair of seats on each of the planar portions 30 and 32 being separated by a recess 44 and, diametrically opposite the recess, a gap 46.

Due to the presence of the recess 44, the portion 48 interconnecting the jaw portions 24 and 26 of each of the planar portions 30 and 32 is relatively narrow: because of the natural resilience or springiness of the sheet metal forming the clamp 28, this portion 48 interconnecting the jaw portions constitutes a resilient bridge portion. The one-piece sheet metal clamp 28 overall provides a "metallurgical hinge" (as opposed to a mechanical hinge requiring a pin to hinge two parts together), utilising the inherent spring characteristics of the steel primarily in the region of the bridge portion 48 of the clamp, and the resulting springiness of the yoke-like clamp is fundamental in providing the desired selective clamping action.

For some applications the sheet metal clamp 28 could alternatively be constituted by a brass stamping.

The sheet metal clamp 28 has opposite side edges 50 and 52 for engagement with facing surfaces of the spaced side members 16 and 18 of the U-shaped bracket 14 when the clamp is received between the side members in the assembled condition shown in Figure 1. Selectively operable actuator means 54 for the clamping action includes a cylindrical actuator housing 56 disposed adjacent an outwardly facing surface of the bracket side member 18, and a rod 58 which has an angled handle portion 60 and also a main portion extending from the actuator housing through an arcuate adjustment slot 64 in the side member 18 and by way of the aligned apertures 42 and 40 in the bent-up lugs 38 and 36 to extend through a similar arcuate adjustment slot 62 in the side member 16. A retainer nut 64 (Figure 3) provided with a washer is mounted on a threaded free end portion of the rod, for co-operation with the bracket side member 16.

The actuator means 54 includes an annular face cam 66 which can either be an insert retained by locating projections of the actuator housing 56 as shown in Figure 1, or might alternatively be an integral part of the actuator housing. A cross pin 68 carried by the rod 58 acts as a cam follower, and a coil spring 70 accommodated within the actuator housing engages the cross pin to provide a biasing and anti-rattle function.

For maintaining the position of the sheet metal clamp 28 relative to the U-shaped bracket 14, locating means is provided in the form of a sheet metal key member 72 having angled first and second end portions 74 and 76 interconnected by a waisted intermediate portion 78 that is slidably received in the adjustment slot 64 of the bracket side member 18. The first end portion 74 extends between the first and second planar portions 30 and 32 of the sheet metal clamp 28 to the region of the tubular jacket 12, and has parallel side edges engaging respective ones of the planar portions. The second end portion 76 is disposed adjacent the outwardly facing surface of the bracket side member 18, and is apertured to accommodate the rod 58 of the actuator means, for retaining the key member 72 in position.

The housing 56 of the actuator means 54 is welded (or otherwise secured) to the second end portion 76 of the key member 72, and is thereby retained, in the axial direction of the rod 58 of the actuator means, by the bracket side member 18, but can slide up and down with the rod. It would alternatively be possible for the actuator housing and the key member to be separate, and disposed on the rod of the actuator means at opposite sides of the U-shaped bracket 14. Another possibility would be for the actuator means to comprise a manual adjustment knob mounted on a threaded end portion of the rod of the actuator means, with the key member disposed at the opposite end of the rod, between the retainer nut and the bracket side member.

The tubular jacket 12 is provided with a projecting guide member in the form of a sheet metal strip 80 which extends longitudinally of the tubular jacket and is secured thereto by rivets (alternatively, screws could be used, or a welded connection, or hollow rivets configured to withstand a minimum predetermined shear force). The guide strip 80 comprises a flat body portion 82 together with upturned end portions 84 constituting end stops. The guide strip 80 is accommodated within the recess 44 of the two planar portions 30 and 32 of the sheet metal clamp 28, with radial clearance between the body portion 82 thereof and the bridge portion 48 of the clamp, and with slight circumferential clearance between the body portion 82 and shoulder portions 86 flanking the bridge portion of the clamp.

The transversely extending connecting portion 20 of the U-shaped bracket 14 is formed with a symmetrically disposed pair of rearwardly open recesses 88 (Figure 4), with a pair of connector capsules (mounting capsules) 90 slidably received in the respective recesses. The connector capsules 90 have respective apertures 92 to accommodate mounting bolts or a mounting stirrup for securement of the U-shaped bracket to a body portion (not shown) of the vehicle, in the general region of the vehicle cowl below the windscreen. The connector capsules 90 are connected to the connecting portion 20 of the U-shaped bracket 14 by frangible connectors 94, for example *in situ* injection-moulded plastics pins, permitting break-away of the bracket 14 from the connector capsules 90 under possible vehicle impact conditions at a predetermined shear force.

In operation, the actuator means 54 will normally be in a locking condition preventing adjustment movement of the tubular jacket 12. In the locking condition, the cam follower pin 68 will be in an "up-cam" position, causing the actuator housing 56 and retainer nut 64 to be positioned such that the spaced side members 16 and 18 of the U-shaped bracket 14 are moved towards one

another sufficiently to cause the curved facing surfaces of the opposed jaw portions 24 and 26 of the U-section sheet metal clamp 28, acting by way of the split bush 22, to exert an effective clamping action preventing both longitudinal and circumferential movement of the tubular jacket 12.

To release the clamping action, for adjustment of the position of the tubular jacket 12, the handle portion 60 of the actuator means 54 is turned to move the cam follower pin 68 to a "down-cam" position establishing a wider spacing of the actuator housing 56 and retainer nut 64, for example a 2 mm wider spacing. In this release condition, the inherent spring characteristics of the steel of the U-section sheet metal clamp 28, primarily in the region of the bridge portion 48 of the clamp, cause spring-back of the opposed jaw portions 24 and 26, by an amount of for example 1 mm or up to the extent permitted by the spacing of the actuator housing 56 and retainer nut 64, to reduce the frictional engagement force of the split bush 22 on the tubular jacket 12 to a level permitting longitudinal adjustment movement of the tubular jacket. The end stops 84 can act to limit such longitudinal adjustment movement, by abutment against the bridge portion 48 of the clamp.

In the release condition of the actuator means 54, also, adjustment of the rake of the column is possible by movement of the tubular jacket in a vertical plane such that the rod 58 travels along the arcuate adjustment slots 62 and 64, with the column pivoting about its lower end, at the steering gear.

The locking condition is re-established by turning the handle portion 60 to return the cam follower pin 68 to the "up-cam" position, so clamping the tubuar jacket 12 firmly in its adjusted position.

In the mounting assembly which has been described, the sheet metal key member 72, as well as supporting the actuator housing 56, prevents the U-section sheet metal clamp 28 from pivoting about the rod 58. The key member 72 also provides support for the clamp 28 in the longitudinal direction of the tubular jacket 12 during possible vehicle impact conditions. The key member could if required be made as a one-piece unit with the actuator housing (and reference has already been made to the possibility of making the face cam an integral part of the actuator housing).

The split bush 22 ensures smooth operation during adjustment, prevents scratching of the tubular jacket by the jaw portions of the sheet metal clamp, and avoids erratic collapse loads during possible vehicle impact conditions.

The guide strip 80, as well as limiting the amount of longitudinal adjustment movement of the tubular jacket in the release condition, also provides an anti-rotation characteristic for the tubular jacket potentially capable of meeting possible anti-theft requirements, in that any attempt to cause enforced circumferential movement of the tubular jacket in either direction would be resisted by abutment of the guide strip with the shoulder portions of the U-section sheet metal clamp. Further, during possible impact conditions co-operation of one of the end stops of the guide strip with the corresponding bridge portion of the U-section sheet metal clamp could provide a significant anti-penetration characteristic, with the recess preventing an abrupt "spike"-type increase in the axially directed absorption force.

The actuator means 54, instead of being a quick-release cam or screw-mounted adjustment knob as described, could in principle be any means for drawing together the jaw portions of the sheet metal clamp, and thus for some applications a motor drive of alternatively magnetic attraction might be found suitable.

CLAIMS

1. A mounting assembly for adjustably supporting a tubular jacket of a steering column relative to a body portion of a vehicle, comprising a U-shaped bracket adapted to be secured to the vehicle body portion and including a pair of spaced side members interconnected by a connecting portion, a resilient bush adapted to engage around a portion of the tubular jacket, a U-section sheet metal clamp received between the side members of the bracket and comprising opposed jaw portions which accommodate the bush and are interconnected by a resilient bridge portion, locating means effective to maintain the position of the sheet metal clamp relative to the bracket, and selectively operable actuator means having a release condition for permitting adjustment of the position of the tubular jacket and a locking condition in which the spaced side members of the bracket, and thereby the opposed jaw portions of the sheet metal clamp, are moved towards one another for locking the tubular jacket in its adjusted position.

2. A mounting assembly according to claim 1, in which the side members of the bracket are formed with respective slots for permitting, in the release condition of the actuator means, adjustment movement of the tubular jacket in a vertical plane.

3. A mounting assembly according to claim 2, in which the actuator means comprises a manually operable actuator portion co-operating with an outwardly facing surface of one of the bracket side members, a rod extending from the manually operable actuator portion and through the two slots, and a retainer mounted on the free end portion of the rod for co-operation with the other bracket side member in the locking condition of the actuator means.

4. A mounting assembly according to claim 3, in which the sheet metal clamp is pressed or stamped from a one-piece blank and includes a pair of spaced bent-up lugs apertured to accommodate the rod of the actuator means.

5. A mounting assembly according to claim 3 or 4, in which the manually operable actuator portion comprises a face cam and follower one of which is

mounted on the rod of the actuator means and the other of which is retained by the said one bracket side member.

6. A mounting assembly according to claim 3 or 4, in which the manually operable actuator portion comprises a manual adjustment knob threadedly mounted on the rod of the actuator means.

7. A mounting assembly according to any one of claim 3 to 6, in which the locating means comprises a key member having a first end portion received within the U-section of the sheet metal clamp, an intermediate portion slidably received in the slot of one of the bracket side members, and a second end portion disposed adjacent an outwardly facing surface of one of the bracket side members and retained by the rod of the actuator means.

8. A mounting assembly according to any one of claims 3 to 7, in which the bush is a channel-section split bush of low-friction plastics material.

9. A mounting assembly according to any one of claims 3 to 8, including a tubular jacket as aforesaid provided with a projecting guide member effective to selectively co-operate with shoulder portions flanking the bridge portion of the sheet metal clamp, to restrict rotary movement of the tubular jacket relative to the clamp.

10. A mounting assembly according to claim 9, in which the guide member is formed with end stops effective to limit longitudinal movement of the tubular jacket relative to the sheet metal clamp.

11. A mounting assembly according to claim 10, in which the guide member comprises a sheet metal strip riveted or otherwise secured to the tubular jacket and having upstanding end portions constituting the end stops.

12. A mounting assembly according to any one of claims 1 to 11, in which the spaced side members of the U-shaped bracket comprises a pair of depending arms, the connecting portion of the U-shaped bracket is formed with a symmetrically disposed pair of rearwardly open recesses, and a pair of connector capsules apertured to accommodate respective securing members are slidably received in the respective recesses and are connected to the connecting portion of the bracket by frangible connectors permitting break-away under impact conditions.

13. A mounting assembly for adjustably supporting a tubular jacket of a steering column relative to a body portion of a vehicle, substantially as hereinbefore particularly described and as shown in the accompanying drawings.

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